Review of the 2006

Environmental Water Account (EWA)

Submitted by the

EWA Technical Review Panel

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To

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Executive Summary

The Environmental Water Account (EWA) Technical Review Panel convened at a workshop on November 28-30, 2006 in Sacramento, California. The Panel was impressed with the noticeable improvement in the quality of the presentations, and the obvious increase in the analytical work that went into the preparation for the workshop. This positive statement has two caveats. First, there is still substantial scope for improving the relevance and efficacy of the EWA, and we offer a number of recommendations intended to help the program continue to improve. Second, the Panel believes that the improvements in the 2006 review were largely the result of the additional funds made available through Pelagic Organism Decline (POD), which reinforces the Panel's recommendations in previous reports that increased funding for research and monitoring was needed and would be beneficial.

The Panel believes that EWA, after a slow start, has accumulated enough information (due in part to the POD effort), to now develop an effective program. Some of our recommendations (e.g., conducting a new gaming exercise) would use this accumulated information to date to refine and strengthen EWA as it goes into the future.

In the following sections of the Executive Summary, we summarize our consensus on the strengths, weaknesses, and recommendations. These are discussed in more detail below in the main body of this report.

Strengths

- The EWA Program continues to assure reliability of water supplies to water users.
- The EWA staff incorporated new decision tools in response to inter-annual and intra-annual changes in water conditions.

- The public is included in the full range of EWA activities.
- CALFED increased funding for research on EWA issues.
- CALFED workshops and seminars disseminate information and help link research to management.
- The EWA is subjected to a multi-tiered review structure.
- Statistical analyses have improved since the last EWA panel review.
- The scientific approach in several on-going projects discussed at the November 28-30 review has improved since the last review.
- The exploratory studies about fish ecology and the use of numerical models, triggered by the POD, are a positive addition to the EWA.

Weaknesses

- The EWA Program lacks measurable performance measures.
- EWA is not integrated into the overall scheme of water management in the system.
- A reduction in the amount of EWA water, and apparent modification or rejection of EWA recommendations, can quickly compromise the value of an EWA program.
- There is not enough water presently committed to EWA to simultaneously manage habitat and water quality, route salmon through the system, and make delta smelt less vulnerable to export pumping.
- A systematic approach is lacking that would allow evaluation of how EWA actions intended to improve conditions for one species may be detrimental to other species of concern.
- Current monitoring is not adequate to determine the effects of EWA on populations of species of concern.
- Identifying the importance of EWA as a factor influencing populations of key species will be difficult because of the small amount of water in the EWA and the large variability in the hydrologic environment that influences the distributions and dynamics of species of concern.
- Hydrographic changes due to climate, consumptive water uses, and water storage are affecting water availability differentially in the Sacramento versus San Joaquin drainage basins. These factors appear to make water management options much less flexible in the San Joaquin side of the system.
- Changes in upstream water use, particularly in the San Joaquin basin, have resulted in a slow and steady change in salinity patterns in the south Delta, especially in the fall. As such, the system is likely being "pressed" towards decreasing habitat quality that could hinder the operation of the EWA.
- Even though the Panel recognizes recent improvements in statistical analysis, additional improvement is needed.
- Real integration of all the sources of environmental water is lacking.
- Other programs, such as Vernalis Adaptive Management Program **(**VAMP), are not subjected to the same level of peer review as the EWA Program.

- In recent years there has been a disconnect between the size of the EWA Program and the expectation that EWA should contribute to species recovery.
- Staff and funding for EWA related research and analysis is diffuse and too small.

Recommendations

- The Panel continues to recommend that research funds be earmarked directly to address EWA issues, and encourages a concerted effort to incorporate the results of the new research into EWA actions and management.
- The Panel encourages the continued use of workshops to address specific topics and issues related to EWA.
- The Panel recommends more use of web-linked documents in reviews. These could supplement the PowerPoint presentations with background information such as the proposals and work plans of projects presented in the reviews.
- The multi-tiered review structure is important and the Panel supports the continuation of reviews of EWA on a bi-yearly basis. The EWA review process should serve as a template for other programs such as the VAMP.
- The Panel encourages continued and expanded use of internal and external statistical consultants.
- Panel encourages the further application of particle tracking models to understand the movement of delta smelt at junctions and to understand the effects of the Head of the Old River Barrier (HORB) on the routing of pelagic organisms and salmonids through the Delta. However, conclusions drawn from the particle tracking experiments are contingent on the assumption that delta smelt move like neutrally-buoyant particles. The panel encourages further studies to understand the effects of life-stage-specific behaviors on the transport of delta smelt throughout the Delta and the effect of exports on their distribution.
- The Panel encourages consideration of the behavioral responses of fishes to hydrologic and water quality signals in connection with the study of junctions and other hydraulic and landscape features in the Delta. The Panel also encourages studies to understand the hydraulic and salinity cues that mediate the spatio-temporal distribution of delta smelt and their entrainment into the pumps.
- The Panel encourages the development of models that estimate the indirect routing effects of exports. The impacts resulting from the routing of fish into regions of the Delta that are favorable or unfavorable to growth and survival of particular life history stages need to be better quantified.
- As in past Panel reports, the magnitude of the indirect effects of the pumps via mortality multipliers (e.g., as used for Clifton Court Forebay) are important to quantifying entrainment effects but still remain unconfirmed.
- Programs such as VAMP should apply mechanistic life cycle approaches that identify factors affecting routing and survival of salmonids through the San Joaquin River and the Delta. In particular, the Panel encourages a mechanistic approach to understand

the effects of the HORB on Delta dynamics and on the survival of San Joaquin salmonids.

- The panel encourages the development of general EWA performance measures and specific EWA performance measures that are linked to critical life stages of the salmonid and pelagic organisms of the Delta.
- Results of the ongoing research should be used to refine the decision support tools. Changing environmental conditions and greater demands on a potentially shrinking supply of environmental water suggests that the water programs would benefit if they were combined into a single coordinated operation and assessment program. The Panel believes that only through a coordinated environmental water program can efficient trade-offs of water allocations be achieved between tributaries and the Delta and across anadromous and resident species**.**
- The panel encourages completion of studies such as Marston and Mesick, Herbold, Swanson, and Miller and, where appropriate, submissions to a peer reviewed journal such as the San Francisco Estuary and Watershed Science, fish ecology journals, and the journal Endangered Species Research (Inter-Research).
- It is important to view all EWA actions in light of the full range of their potential effects on the multiple species of concern, rather than their effects on single species. To maximize the effectiveness of EWA water, it may be necessary to identify tradeoffs associated with actions that benefit one species at the expenses of others. This may ultimately lead to prioritization of actions based upon the relative risk of jeopardy among species at-risk.
- Both winter run Chinook salmon and delta smelt would benefit if the water exported at the pumps was derived mostly or entirely from the San Joaquin River; thus resulting in positive flows in the Old and Middle Rivers. Such actions would, however, have to be weighed against the potential negative impacts on San Joaquin salmon runs of the increased use of San Joaquin water.
- It may be necessary to re-engineer the system to maximize the potential for export of San Joaquin River water before it reaches the Delta. This may not be possible if San Joaquin flows are insufficient under the current management regime to satisfy the water volume needs at the pumps.
- The Panel believes that knowledge of cause and effect may be enhanced by increased flexibility in the methods and locations of data collection, including new studies and monitoring specifically designed to address process-level questions.
- We are recommending new studies, both descriptive and experimental, that are informed by the new information gained as a consequence of the POD efforts. If no new EWA-specific sources of funding can be obtained for this purpose, it may be efficacious to dedicate a small portion of the EWA funds now used for buying water to new studies, despite the aforementioned problem of decreasing trends in the amount of EWA water. In the long term, this maybe a good trade-off for improving the efficiency of the EWA.
- While the Panel recognizes the improvement in statistical analysis demonstrated at the 2006 review, there is still a need to improve statistical rigor and discipline in data analysis. Further attempts at data mining that is not hypothesis driven is discouraged. Group collaboration is needed to resolve the apparent discrepancies in conclusions

reached by different people seemingly analyzing the same data using similar techniques.

- There are several ways to improve the quality of data collected relative to its quantity, and the recommendations of the Panel fall into three general areas:
    1. Focus on needs identified during development of population models to elucidate cause and effect, and to inform the models;
    2. Narrow the questions attempting to be addressed and focus on the factors affecting the distribution and abundance of all life stages of delta smelt in space and time, including delineation of spawning habitat. Many of these questions can be addressed by amending the existing sampling programs. However, keep in mind that sampling stations used for multiple purposes can compromise their value;
    3. Determine to what extent the lack of understanding and quantification of gear efficiencies can mask relationships, inflate uncertainty, and preclude defensible estimates of population size based upon the monitoring results.
- Suggested areas for new research include but are not limited to: behavior of fish in responses to flow; improvements in monitoring in real time; genetics studies for better identification of members of specific salmon runs; estimation of mortality of delta smelt and salmon smolts in the Delta, in the Clifton Court Forebay, and in the pumping facilities; and accurate estimates of entrainment (including indirect effects) of all at-risk species and life stages.
- The Panel endorses the idea of viewing environmental water from all sources together as a common pool. We encourage efforts to waive or remove, as much as possible, institutional barriers that hinder the pooling of environmental water from among the different sources.
- In a future environmental water program, either aiding recovery is a goal and sufficient water is allocated to achieve it, or the goal should be revised so expectations are compatible with the amount of water made available.
- A fish life cycle approach should be the cornerstone for a future environmental water program.
- Dedicated staff and funding is the most efficient way to achieve the level of quantitative analyses needed in a future environmental water program. A future environmental water program should also have the resources to support research and analysis of its specific questions and issues. Examples of EWA-centric analyses include, but are not limited to, population estimation from monitoring data, what to do in wet years (given that recent wet years did not benefit fish as expected), statistical analysis of data on spatio-temporal distributions of life stages and mortality rates, trade-offs between upstream and downstream actions and among multiple species, and the likely effects of climate change.
- It is time to revisit gaming to help size and “optimize” the mix of actions under different conditions (e.g., wet versus dry years) in a future environmental water program. A new gaming exercise should also include biological life-cycle models that were not available ten years ago.

Introduction

The EWA Technical review Panel (members listed in Appendix 1) convened at a workshop on November 28-30, 2006 in Sacramento California[1]. As in past years, the panel was charged with the preparation of a report that provides "… a comprehensive evaluation of the EWA to determine the biological benefits of EWA and other environmental water in recovery of at-risk native species and provide recommendations on water allocation priorities…." Within this context, there were seven specific questions in the charge to the Panel and we considered these in preparing this report.

Following the public presentations at the November 28-30 workshop, the Panel met to discuss the results of the workshop and to draft a preliminary set of findings. Dr. Kenny Rose presented those findings to the meeting participants on the morning of November 30, 2006. After the presentation, there was a lengthy and informative discussion between Panel members and the audience. The presentations and the discussions during the workshop and after the preliminary presentation of Panel findings were considered in the Panel's responses to the seven questions stated in our charge.

The Panel wishes to acknowledge the hard work and dedication of everyone who contributed to the workshop. We realize the workshop was a major undertaking and want to thank all of the presenters and participants for their efforts. We also wish to acknowledge that the technical quality of the presentations in this year's workshop was noticeably improved over past workshops. This positive statement has two caveats. First, there is substantial scope for improving the relevance and efficacy of the EWA, and we offer a number of recommendations intended to help the program continue to improve.

[1] Dr. Paul Smith of the EWA Review Panel was unable to attend the November 28-30 workshop in Sacramento.

Second, the Panel believes the improvements in the 2006 review were largely the result of the additional funds made available through Pelagic Organism Decline (POD), which reinforces the Panel's recommendations in previous reports that increased funding for research and monitoring was needed and would be beneficial.

This year's report is organized as follows: In the first section we present the many positive findings and accomplishments of the EWA program. The second section addresses the seven questions in our charge. In both sections, we offer suggestions for improvement in the implementation of the EWA[2]. Our recommendations are highlighted in bold in the text of the report and also listed in the Executive Summary.

Positive Findings for 2006

In its sixth year, the Environmental Water Account (EWA) program demonstrated continued improvement and progress. Notable accomplishments are listed below:

Water Supply Reliability

As in the past, the EWA program has assured reliability in water supplies at no cost to the water users; and, as noted in other reviews, efforts have continued to creatively diversify resources, and to develop models of acquisition, storage, and debt.. The real-time allocation of EWA and (b)(2) water is a complex, but for the most part, efficient process that has steadily improved over the life of the EWA program. The EWA staff demonstrated its ability to incorporate new decision tools and information and to

[2] The reader should be aware that several recommendations by the Panel center on the full life cycle approach, which can include, but does not necessarily have to include, numerical population models. Several members of the review panel have funding from CALFED to develop numerical life cycle population models.

adjust to the year-to-year and within-year changes in water conditions. This component of the EWA program runs in an orderly way.

Public Outreach

The efforts to include the public in the full range of EWA activities from annual workshops and reviews to weekly meetings on technical issues, water negotiations, and environmental compliance is highly commendable and has no doubt contributed to the operational success and acceptance of the program. Of particular note, was the active participation of stakeholder scientists and consultants in the data analysis and planning process for the POD. The Panel appreciates their contributions and sees their unique insights and perspective as especially valuable.

Science Funding

In past reviews the panel expressed concern about the lack of funding for research on EWA issues. However, it appears this problem has, in part, been resolved. The CALFED Science Focused Proposal Solicitation Package requested proposals on "Environmental Water," "Trends and Patterns of Populations and System Response to Changing Climate" and "Habitat Availability and Response to Change." The Panel sees the CALFED Science Fellows Program as especially valuable, and notes that in 2005 and 2006 the Fellows Program provided support for graduate and post-graduate fellows in research areas directly relevant to EWA issues. As a result of these earmarks, a number of high quality proposals and researchers were funded. The Panel commends these actions and encourages a concerted effort to incorporate the results of the new research initiatives into EWA management. In particular, the POD workshops and analyses, which

were independent of the EWA, were highly valuable in providing information on delta smelt. **The Panel continues to recommend research funds be earmarked directly to EWA issues and encourages a concerted effort to incorporate the results of the new research into EWA management**.

Exchange of Ideas

The CALFED workshops and seminars related to EWA actions and issues are excellent vehicles linking research and management, and also serve as a means for disseminating information to the public. **The Panel encourages the continued use of workshops to address specific topics. For example, a seminar or workshop on the response of juvenile salmon to hydraulic conditions at bends and junctions would help to complement the new research on that issue that is becoming available.**

Program Documentation

The panel appreciates CALFED and the EWA staff for their effort in developing presentations and documentation for the November 28-30 workshop. The cross-linked, web available presentations and background material, and the summary documents by the science advisors, were of great help. The EWA staff document "Improving the EWA implementation process: Science program and EWA agencies progress in water years 2005 and 2006" is noteworthy in that it included past panel recommendations, actions taken by agencies, action goals, resource commitments, and progress in implementing the recommendations. **The panel recommends using this structure in future reviews. The panel recommends more use of web-linked documents in reviews. These could**

supplement the PowerPoint presentations with background information, such as the proposals and work plans of projects referred to in the presentations.

Reviews

We note that the EWA program is among the most reviewed and critiqued of all CALFED programs. Besides the five formal reviews by EWA Technical Review Panels, the science advisors have provided insightful and clear assessments of the strengths and weaknesses of the program (e.g., Brown et al. 2006) and internal assessment of the status of implementation of EWA (Chappell et al., 2006). The workshops provide additional review and oversight of the program, and are useful in identifying impediments to the further development of science-based management of environmental water. **This multi-tiered review structure is important and the Panel supports the continuation of EWA reviews on a bi-yearly basis. The EWA review process should serve as a template for other programs such as the VAMP.**

Improved Statistical Analyses

Statistical analysis of EWA studies has improved since the inception of the program. Noteworthy are the review of delta smelt analyses by a statistical consultant and the inclusion of a statistician on the EWA staff. Additionally, the new Delta Action 8 studies on reach survival will use the Jolly-Cormack-Seibert survival methodology, which is the state of the art for such studies. **The panel encourages expanded use of internal and external statistical consultants.**

Improved Scientific Thinking and Conceptual Models

In the first year of the EWA program (2001), the allocation of water resources was driven by the need to reduce the take of organisms at the pumps. In the second year review (2002), the Panel advocated developing life cycle models of delta smelt and salmon, and in the fourth review (2004) the Panel recommended quantifying the impact of exports through population models. In this year's review (2006), the Panel notes progress in the use of mechanistic and life cycle perspectives to characterize the impacts of water exports. The Panel notes that several biological responses are now being tracked, including take at the pumps, passage of fish at the Delta Cross Channel, and the delineation of the Delta entrainment zones. We list eight studies that demonstrate an improved scientific approach.

- In the 2004 review, the Panel recommended the Particle Tracking Model (PTM) be used in EWA decision-making and research; this occurred in 2005 and 2006. The model allows managers to address the effects of EWA actions on delta smelt prior to their entrainment at the pumps. The application of the model is a first step in the real-time management process envisioned by the Panel in past reviews. **The Panel encourages the continuation of this work and the further application of particle tracking models to understand the movement of delta smelt at junctions and the effects of the HORB on the routing of pelagic organisms and salmonids through the Delta. However, conclusions drawn from the particle tracking experiments are contingent on the assumption that delta smelt move like neutrally-buoyant particles. Moreover, it is vital that any model that is used must be properly calibrated and verified. At present, the main tool in use DSM2/ PTM, does no meet these criteria. The panel**

encourages further studies to understand the effects of life stage specific behaviors on the transport of delta smelt throughout the Delta, and the effect of exports on their distribution.

- The use of Old and Middle rivers flows as a measure of export impacts is a significant improvement over expressing impacts in terms of export itself, and is an example of the increased scientific approach to analyses.

- Past studies in the Delta Action 8 and VAMP have demonstrated the effects of exports, Delta operations, and temperature on juvenile salmon migration and survival. The Panel finds the study characterizing the distribution and behavior of salmonids in the flow field of a river bend (Burau 2006), is a logical and important follow-up to these initial studies. Better understanding of the routing of fish within and through the Delta in terms of the fish's behavioral responses to hydraulic and water quality signals is essential to efficiently target environmental water to key life stages of the species at-risk. **The Panel encourages incorporating the fish's behavioral responses to hydrologic and water quality signals into the study of effects of junctions and other hydraulic features in the Delta landscape. The Panel also encourages studies to understand the hydraulic and salinity cues that mediate the delta smelt's distributions and entrainment into the pumps.**

- Dr. Bennett's conceptual model of the impacts of early spawning delta smelt on population dynamics is commendable and provocative. Embedding his analysis of delta smelt in a life history context differentiated his talk from many of the other presentations. Without commenting on Dr. Bennett's specific analyses here, the

Panel again encourages greater use of mechanistic life history approaches, like used by Dr. Bennett, to identify the impacts of water exports on fish populations in the Delta. If factors (both natural and managed) affecting delta smelt life history were coupled to factors affecting the salmon's juvenile life histories, a better understanding of the relevance of the site-specific mortality rates would emerge that could also expose areas where additional information on the life history-habitat relationships are needed. The technical panel that reviewed the OCAP Biological Opinion also suggested that the impacts of the Central Valley Project (CVP) and State Water Project (SWP) be placed in a life cycle context (Technical Review Panel 2005). An example of the life cycle approach can be found on pages 14-17 of that report.

- In the early years of the EWA program, fish routing was characterized by the recovery of coded wire tagged (CWT) fish and by "take" at the pumps. The effect of exports was characterized by aggregate measures of the export and import ratio, averaged across somewhat arbitrary temporal intervals. The resulting correlations were weak and revealed little of the biological mechanisms by which EWA actions affected fish survival and Delta routing. As a result, past EWA Panels suggested greater effort be given to identifying movement and site-specific mortality of both salmonids and delta smelt. To this end, the salmonid monitoring workshop in 2005 addressed ways to improve the monitoring program. In particular, the ultrasonic tagging system with multiple detectors throughout the Delta and the estuary is a substantial improvement and will yield estimates of

juvenile salmon survival and travel time through the freshwater habitat and into the ocean.

- The Panel believes that it is important to quantify the effectiveness of the EWA program in terms of the number of salmonids and delta smelt saved by EWA actions. Quantitatively estimating impacts is difficult and the Panel commends the initial estimates of the direct impacts of exports put forth by some of the participants at the workshop. **The Panel encourages the development of models that estimate the indirect impacts of exports. It is essential to understand those impacts resulting in the routing of fish into regions of the Delta that are favorable or unfavorable to growth and survival of particular life history stages.**

- While several CALFED programs have applied life cycle approaches to varying degrees, other programs have yet to move beyond the exploratory stage involving linear regressions of fish impacts against exports or total river flows. **Programs such as VAMP should apply mechanistic life cycle approaches that identify factors affecting routing and survival of salmonids through the San Joaquin River and the Delta. In particular, the panel encourages a mechanistic approach to understand the effects of the HORB on Delta dynamics and the resulting survival of San Joaquin salmonids.**

- In the first EWA review, take at the pumps was the primary focus used to manage the EWA water allocations. Now a variety of measures, such as smolt passage, smelt entrainment patterns, and Old/Middle River flows, are used in the Salmon Decision Tree and the Delta Smelt Risk Assessment Matrix. The incorporation of

these ecologically-based measures is a positive development. **The Panel encourages the development of general EWA performance measures and specific performance measures that are linked to critical life stages of the salmonid and pelagic organisms of the Delta.**

Real-time Tools

The array of decision support tools used in the within-season targeting of environmental water for salmon and delta smelt is commendable. **The results of the ongoing research should be used to refine the decision support tools. Changing environmental conditions and greater demands on a potentially shrinking supply of environmental water suggests that the water programs would benefit if combined into a single coordinated operation and assessment program. The Panel believes that only a coordinated program can achieve efficient and effective trade-offs of water allocations between tributaries and the Delta and across anadromous and resident species.**

Exploratory Studies

While the Panel encourages the development of life cycle based studies, it also sees as positive the expansion of exploratory analyses that seek to identify correlations between water properties and fish. Examples at the workshop was the Marston and Mesick (2006) study of San Joaquin flow and fall Chinook survival, and the studies of delta smelt historical patterns by Herbold, Guerin et al., Swansen, and Miller (Manly 2005). **The Panel encourages completion of these studies and, where appropriate,**

submissions to a peer reviewed journals, such as the San Francisco Estuary and Watershed Science, one of the many fish ecology journals, and Endangered Species Research (Inter-Research).

Response to Questions

We took the liberty, when necessary, to revise the questions to either clarify their intent or to narrow their scope. For example, we did not address the "other environmental water programs" mentioned in the first question because the Panel was not given enough information on those programs. Because the questions overlap to some extent, our responses also overlap and similar information may appear in the responses to multiple questions.

1. ***Has there been enough EWA water (in principle) to enable actions sufficient to reduce the impacts of water management on the species of concern in the Delta and associated tributaries?***

The Panel recognizes the significant progress and effort put forth to document the impacts of EWA actions, and concludes that EWA has been successful in reducing some of the impacts of water management with respect to the take-oriented objectives originally outlined for the EWA program in the Record of Decision (ROD). There is no doubt that EWA actions have reduced "take" at the export pumps, but there still appears to be insufficient data to definitely quantify the population level consequences of these reductions in take. Impacts can be either positive or negative, and, as posed to the Panel, the intent of the question is not well defined. For example, it is not clear how much reduction in take is required to have a substantial, or even measurable, effect on the

recovery of threatened species such as the delta smelt. **This highlights the need to define performance measures for the EWA program, and its relationship to other ongoing environmental and water management programs in the Delta**.

The Panel is very concerned about disturbing trends that may compromise the EWA's future value as a management tool. For example, reductions in the amount of EWA water available, and efforts to reject or modify recommendations for EWA actions, will undoubtedly compromise the program's efficacy. Furthermore, the Panel is concerned that EWA is not fully integrated in the overall scheme of water management in the system.

Despite the lack of definitive analyses, the Panel concludes that the amount of water available to EWA is not sufficient to be effective in the larger environmental context of triggering measurable population level effects. There is not enough water to simultaneously manage habitat and water quality, route salmon through the system, and make delta smelt less vulnerable to export pumping. In this larger context, the Panel is certain that more EWA water will be needed as the EWA moves into the future, or at the very least the EWA will need to be tightly integrated with actions derived from other sources of environmental water in the system. The panel was not provided enough information to evaluate the current level of integration among all sources of environmental water, hence it was not possible to assess impacts of other environmental water programs, particularly as they relate to EWA water. This is especially true for b(2) water.

The panel also believes that alternatives to reductions in export pumping will be required to recover at-risk populations, including those that may require redesign of the "plumbing" in the estuarine watershed.

2. ***Have the EWA and the other environmental water programs effectively contributed to recovery of the species of concern in the Delta and associated tributaries?***

Since the presentations at the workshop gave no evidence that any of species of concern have "recovered," the Panel was not sure of this question's intent. Environmental water programs appear to have produced mixed, localized results; for example, positive effects in Clear Creek, but a declining salmon population in the Stanislaus. In general, the answer to this question combines the answers to questions 1, 3, 4, and 5. To contribute to recovery there would have to be enough water to reduce impacts (question 1). To determine if EWA and other environmental water contributed to recovery there would have to be sufficient information from all sources (question 3). Of course, to acquire the needed information to determine if EWA effectively contributed to recovery, monitoring would have to be adequate and if it wasn't the Panel should recommend changes (question 4 and 5).

In principle, could the EWA contribute to recovery of species of concern in the future? This is another way of asking question 2 and our responses to questions 6 and 7 are at least partial answers. To enhance the EWA's ability to contribute to recovery, the current EWA program should address the following:

- The EWA needs more flexibility in how the EWA assets are acquired and used.
- The amount of water available to EWA appears to be decreasing. This should be corrected.

- The pool of environmental water from all sources needs to be as fully integrated as legally possible.
- More storage and carry-over capabilities should be identified or developed.
- Funding for research and analysis on EWA related issues should increase.
- Thinking, planning and priority for the EWA should be in the context of a long-term commitment. While short-tem "panic" projects will surface, they should be in addition to EWA and should not distort the long-term commitment to an EWA or environmental water program.

These concerns are discussed in more detail in the responses to the other questions.

3. Are there sufficient information and data from all sources to determine the effects of EWA and other water programs to species of concern (i.e., populations of delta smelt and salmonids)?

There exists high quality data and models that allow us to assess how EWA affects the *physical* environment of the Delta (i.e., how changes in flows (and other operations) affect transport paths and physical characteristics). Moreover, for selected species of interest (i.e., delta smelt), there exist data about spatial and temporal variations in abundance, fecundity, etc., although analysis of the data is relatively recent (see Bennett 2005). It should be noted that current low population levels of delta smelt further confound attempts at monitoring their spatial and temporal distributions. The crucial missing components are information, models, and clearly stated hypotheses about the connection between physical characteristics and biological dynamics and variability. Making these connections is especially difficult given the small responses that may be inherent if the physical environment changes are to be attributed to the relatively small amount of water currently available to EWA.

To properly address this question, the Panel contends that the available data must be assessed in light of the need to test specific hypotheses about EWA effects on specific life stages and processes, for example:

- Are there sufficient data to determine the effect of EWA on pumping induced mortality? The underlying assumption here is that we can *a priori* establish the level at which this source of loss is significant to the population. In this case, there is sufficient data to make a reasonable (uncertainty yet to be defined) connection between what portion of the population is drawn towards the pumps given a measurement of how delta smelt are distributed throughout the Delta. The data and information limitations are lack of knowledge of fish behavior and the fact that the predictive step requires use of a model (PTM) that has never been fully or completely validated so that its accuracy is unknown. Unfortunately, fish salvage cannot be related accurately to entrainment into Clifton Court because the effects of predation and screen efficiency are highly uncertain.
- If it is hypothesized that habitat availability limits delta smelt abundance in some way, then the question would be: Are there sufficient data to determine effect of EWA on suitable habitat for delta smelt at different life stages? For water characteristics like salinity, light, temperature, or contaminant concentrations, the answer is yes. However, again this kind of information cannot currently be translated into population level effects largely because of a lack of synthesis rather than lack of data. The Panel is aware however that one major data gap does exist in this regard: we have no data pertaining to what spawning substrate delta smelt are using, and whether or not this substrate is limiting.
- A third possible hypothesis is that delta smelt are food limited in some way. In this case, the question would be, does EWA affect food web dynamics in a way that is relevant to delta smelt growth, survival or reproductive output, and is

measurable? In this case, while we do have the data and models that can link different hydrologic conditions and operations to primary production, we cannot connect changes in primary production with food limitation at any life stage for delta smelt.

This difficulty in connecting observable changes in Delta conditions in response to water operations like the EWA must be seen in light of the decades-long effort by the Inter-Agency Ecological Program (IEP) to address this question for the much larger quantities of water associated with overall diversions from the system. In this larger context, we know that at the broadest levels there are relationships between flow and abundance of many organisms (Jassby et al 1995), although not for delta smelt. However, the mechanistic basis of those relationships, while largely reasonable, is still based on unproven hypotheses.

In summary, the Panel (again) asserts that attempts to tease out the singular importance of the EWA as a factor affecting the populations of key fish species are unlikely to yield definitive results, given the relatively small size of the EWA and the large inherent variability of the underlying hydrologic environment inhabited by the fishes of interest. Analyses are emerging that move towards documented and well-stated hypotheses (e.g., negative (southward) flows in Old and Middle Rivers are likely to result in increased salvage of delta smelt). The Panel feels that such hypothesis-driven research and analyses is necessary for significant progress to be made. The magnitude of the benefit and the efficacy of the EWA as a tool in restoring and sustaining threatened fish populations in the Delta remain to be determined. As suggested by Wim Kimmerer's

preliminary analyses: EWA at its current size might only be expected to yield a small (on the order of a few percent) change in overall population levels.

For salmon, there appears to be sufficient information from the Delta 8 study to estimate the effect of the EWA on the migration and routing of juvenile Chinook salmon. Patterns between Vernalis flow and the HORB operations and San Joaquin salmon migratory survival and adult returns suggest that water operations may affect these fish. However, the data are limited and because correlation does not imply causation, the Panel does not believe sufficient information or documentation is available to ascribe the patterns to specific operations.

Finally, the Panel thinks it useful to draw attention to the difficulties inherent in attempts at engineering the operation of the Delta. It seems highly likely that EWA actions aimed at helping San Joaquin salmonids (e.g., VAMP-related actions), might have negative consequences for delta smelt, especially when exports are maintained and the HORB is in place. **Thus, it seems important to view any EWA actions in light of their full range of potential effects, rather than only in terms of their effects on single at-risk species.**

4. ***Is the current monitoring effort by the agencies sufficient to provide the needed information on population level effects and responses to EWA water use? and,***

5. ***If there is insufficient data and information to determine the efficacy of the EWA, what scientific approaches are needed to address the problem and allow that determination?***

The Panel commends the agencies for obvious and accelerated progress in using the monitoring data to explore the population level effects of hydrologic variability and

EWA actions. It was very clear to the Panel that much has been learned since the last EWA Panel review. There was a lengthy discussion at the workshop about whether the new findings were attributable to EWA science or to the POD crisis. Regardless, the Panel is not surprised that significant progress was made in response to new monetary and personnel resources being devoted to the collection, management, and interpretation of existing and new data. From the first technical review to the most recent, the Panel has always suggested that allocation of additional resources to monitoring would pay high dividends.

Some important issues (dilemmas) were raised during the 2006 review, and the Panel believes these new issues could have considerable influence on data needs, and therefore on the goals and designs of current and future monitoring. These issues include:

- Hydrographic changes due to climate, consumptive water uses, and water storage affecting water availability differentially in the Sacramento versus the San Joaquin drainage basins. These factors appear to restrict water management options in the San Joaquin side of the system;
- Changes in upstream water use, particularly in the San Joaquin basin, have resulted in a slow and steady change in salinity patterns in the south Delta, especially in the fall. As such, the system is being "pressed" towards decreasing habitat quality for some desirable species and species distributions could shift;
- **Both winter run Chinook salmon and delta smelt would benefit if the water exported at the pumps was derived mostly or entirely from the San Joaquin River, thus resulting in positive flows in the Old and Middle Rivers.**

However, the use of San Joaquin water could have negative impacts on the salmon runs in the San Joaquin basin.

- **In its current size and application, the EWA is not sufficient to address the water-routing issues described above. It may be necessary to re-engineer the system to maximize the potential for export of San Joaquin River water before it reaches the Delta. This may not be possible if San Joaquin flows are insufficient to satisfy the water volume needs at the pumps under the current management regime**. The Panel also believes that future EWA actions could become more important, especially for delta smelt, if San Joaquin River flows continue to decline.

These issues put pressures on the monitoring program because they can affect the utility of presently collected data. Dealing with these issues will require either changes to the existing monitoring program, or additions to the existing monitoring program, in order to generate the data needed to quantitatively accommodate or evaluate these issues.

To maximize the effectiveness of EWA water, it may be necessary to identify tradeoffs associated with actions that benefit one species at the expense of other species, which may ultimately lead to prioritization of actions based upon the relative risk of jeopardy. These tradeoffs will need to be quantified and dealing with these tradeoffs will require "new thinking" about monitoring and data collection. Can sufficient data be collected to allow for quantification of the population-related effects of management actions on multiple species, and can the quantification be precise and accurate enough to allow evaluation of tradeoffs?

The Panel was buoyed by some of the analyses that used the monitoring data presented at the review workshop, such as the "big mama" hypothesis addressed by Dr. Bennett and attempts to combine existing data in new ways (e.g., results from particle tracking models and salvage data to estimate entrainment rates). The Panel believes strongly that "new thinking" will continue to result in improved understanding of cause and effect in the system. **The Panel also believes that knowledge of cause and effect may be enhanced by increased flexibility in methods and locations of data collection that include new studies and monitoring specifically designed to address process-level questions.** However, this does not mean that the Panel is recommending abandonment of existing monitoring sites that are valuable because they have been sampled over many years. Historical perspective is important. **Rather, we are recommending new studies, both descriptive and experimental, that are informed by the new information gained as a consequence of the POD funding. If no new EWA-specific sources of funding can be obtained for this purpose, it may be efficacious to dedicate a small portion of the EWA funds now used for buying water to new studies, despite the aforementioned problem of decreasing trends in the amount of EWA water. In the long term, this maybe a good trade off for improving the efficiency of EWA water use.**

With that said, **the Panel also recognizes the need to improve statistical rigor and discipline during data analysis. Further attempts at data mining that is not hypothesis driven is discouraged.** The group should avoid development and interpretation of numerous regression analyses based upon the same data, especially ratios of data, without considerations of statistical assumptions and possible

multicolinearity of independent variables. Given the data at hand, analysts should also consider power analysis to determine the size of effects that can be realistically identified.

In order to prevent the pitfalls associated with contradictory results from similar data and analyses, the Panel feels strongly that it is important now for the agency and stakeholder groups to close the loop and begin a new phase of cooperation and collaboration among analysts. This cooperation is needed to rectify disparate interpretations about cause and effect based upon results employing the same monitoring and special studies data sets. Consensus will be extremely important when deciding how EWA should proceed beyond 2008.

There are numerous other ways to improve the quality of data collected relative to its quantity, and the recommendations fall into the following three general areas:

- **Focus on needs identified during development of population models to elucidate cause and effect, and to inform the models;**
- **Narrow the questions attempting to be addressed and express them as well-documented and clearly stated hypotheses. Focus on the factors affecting the distribution and abundance of all life stages of delta smelt in space and time, including delineation of spawning habitat. Many of these questions can be addressed by amending the existing sampling programs. Keep in mind, however, that sampling stations used for multiple purposes can compromise their value; and,**

- **Determine to what extent the lack of understanding and quantification of gear efficiencies can mask relationships, inflate uncertainty, and preclude defensible estimates of population size based upon monitoring results.**

Other focus areas for new research include but are not limited to: behavior of fish in responses to flow; improvements in monitoring in real time; genetics studies for unequivocal identification of members of specific salmon runs; estimation of mortality rates of delta smelt and salmon smolts in the Delta, in the Clifton Court Forebay, and in the pumping facilities; and estimates of entrainment of all at-risk species.

6. What scientific components should be considered while implementing EWA in 2007?

We interpreted question six as a direct reference to the Action Matrix. The Panel's review of the Action Matrix was sent to the Lead Scientist in a letter dated January 2, 2007 (See Appendix 2).

7. What scientific components and considerations should be included in a future and/or long-term environmental water program? Are there components that could be included to improve our understanding of water management on ecosystem function and species' population dynamics?

The Panel wants to emphasize that it agrees with the presumption in the wording of the question that there should be an overall environmental water program. **The Panel endorses the idea of viewing environmental water from all sources together as a common pool. We also recognize that there are legal issues and binding agreements**

that dictate that some of the environmental water must be used in certain ways. We encourage efforts to waive or remove, as much as possible, institutional barriers that hinder the pooling of environmental water from all sources.

Another important component to a future environmental water program, and critical to a common water pool approach, is that all programs using the water should be reviewed. These include programs like VAMP and the use of b(2) water. One should not simply collate the current sources of environmental water, but rather a fish life-cycle approach should be used to determine the best mix of actions from an environmental water program. We emphasize the *integration* of environmental water and actions in an environmental water program; simply putting the present separate sources of environmental water together in a single list is not integration. There must be flexibility in how the water is used, and there must be the ability to store and carry-over water between years.

A related consideration is that somehow enough water must be dedicated for environmental use to make an ecological impact. This begins to be achievable if the environmental water from multiple sources is pooled. In addition, more water, without any constraints associated with its use, should be added to the pool. In recent years, there has been a disconnect between the size of the EWA (about 300,000 acre-feet of water) and the expectation that EWA should contribute to species recovery. **In a future environmental water program, either aiding recovery is a goal and sufficient water is allocated, or the goal should be revised so expectations and resources are compatible.**

A fish life cycle approach should be the cornerstone for a future environmental water program. We encourage the steps that have been taken in EWA towards the broader life cycle view of the key species such as delta smelt. The idea of using water to help the species at risk beyond reducing take (e.g., to improve habitat) is gaining momentum and the Panel encourages continued thinking in this direction in a future environmental water program.

A future environmental water program should include an analysis component with dedicated resources (either staff or contracting money). Analysis here includes quantitative methods such as statistical analysis of data, population modeling of key species, and gaming. Progress in statistical analysis and population modeling was evident at the November 28-30 workshop. However, some of these advances were in response to POD pressure, rather than directly due to EWA issues. The progress in data analysis and modeling needs to continue and accelerate, and must play a major role in a future environmental water program. Statistical analyses need to move beyond the linear regressions of index variables towards process-based analyses. **Dedicated staff is the most efficient way to achieve the level of quantitative analyses needed in a future environmental water program**. Difficulties with contracting were a hindrance in the past but this seems to have greatly improved. The CALFED Science Program has played a role to date and should play an increasing role in analysis support in a future environmental water program.

Gaming proved very valuable for initially sizing the EWA. It has been about ten years since that initial gaming exercise. **It is time to revisit gaming to help size and "optimize" the mix of actions under different conditions (e.g., wet versus dry years)**

in a future environmental water program. A new gaming exercise can now include biological life-cycle models that were not available ten years ago.

Additional critical aspects for a future environmental water program are achieving greater water supply reliability, better mechanisms for purchasing environmental water, and cooperation among agencies and stakeholders. Judging by the lack of conflict in recent years, these seem to have been successful in the EWA to date and should be continued. However, prior success should not lead to complacency about these important issues in the future.

Finally, a very important component that is missing from the present EWA is research and monitoring. Monetary and staff resources should be set aside to support research on specific questions that will arise with an integrated environmental water program. The analysis component discussed above would be a part of this research and monitoring component. A future environmental water program will clearly benefit if CALFED Science funds projects and other supporting activities (e.g., population models, workshops, Science Fellows). But one cannot guarantee that all questions that will arise in an environmental water program will be addressed in a timely manner *via* proposal solicitations. Also, while the recent surge of effort associated with the POD has benefited the EWA, this cannot be assumed to continue into the future. **Therefore a future environmental water program should have the resources to support research and analysis of its specific questions and issues. Examples include, but are not limited to, population estimation from monitoring data, what to do in wet years (given recent wet years did not benefit fish as expected), statistical analysis of data, trade-offs between upstream and downstream actions and among multiple species, and the**

likely effects of climate change. The Science Program can be used to help select the contractors and coordinate the funding details. Also, there should be a monitoring component to a future environmental water program designed to specifically track the effects of environmental water program actions. This monitoring would best be done as additions and modifications to the IEP and other sampling that has been done to date to ensure continuity over time, but with the specific goal of tracking environmental water program actions through the life cycles of at-risk species.

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Appendix 1

EWA Review Panel Members:

NAME	AREA OF EXPERTISE
Jim Anderson	Salmonid biology
Jim Cowan	Fish biology
Jim Lichatowich	Salmonid biology
Ron Kneib	Landscape ecology, estuarine fisheries
Steve Monismith	Hydrodynamics
Kenny Rose	Fish biology, population modeling
Andy Solow	Biostatistics
Paul Smith	Fish biology
Buzz Thompson	Natural resource law, Water law

Appendix 2

January 2, 2007

Dr. Michael Healey
Lead Scientist, California Bay-Delta Authority
CALFED-CBDA
650 Capitol Mall, 5th Floor
Sacramento, CA 95814

RE: Review of Resource Agencies Action Matrix for 2007

Dear Dr. Healey:

The EWA Technical Panel attended the annual program review on November 28-30, 2006. As in past years, the panel was charged with the preparation of a report that provides, "… a comprehensive evaluation of the EWA to determine the biological benefits of EWA and other environmental water in recovery of at-risk native species and provide recommendations on water allocation priorities…." We were given seven questions to consider when preparing our report. This year the Panel was requested to address an additional task. We were asked to prepare a separate evaluation of the Resource Agencies Action Matrix presented at the program review by Jim White and Kevin Fleming. We were given five questions to consider when preparing that report. The purpose of this letter is to present our findings on the Action Matrix.

The matrix lists six potential experiments, and for each, there are nine cells that give information such as the timing of the action, triggering events, scientific uncertainty, and response variables. The information in each cell is reduced to bullet form, which gives an indication of the thinking that went into the design of a proposed action, but not a complete description of it. On December 11, 2006, the Panel received supplemental information on the matrix, which did provide new insight into the rationale for the proposed actions, but was still considered insufficient for a detailed review by the panel.

We generally agree in concept with the approach described in the matrix and supplemental information such as describing the actions, their rationale, response variables, etc. This approach gives the management actions an improved technical basis. The panel encourages the managers to continue with this approach and, in the future, provide more explanation and scientifically defensible justification for the actions and to quantify as many of the components of the matrix as possible. Our answers to the five questions suggest the kind of additional information that would be useful.

We disagree with the use of the term "experiment" to describe the management actions in the matrix. Labeling the management actions as experiments creates the temptation to over interpret the results and it may suggest that the results have greater validity than is warranted. The lack of experimental controls (to compare with the treatment) and little or no replication undermines the power and rigor of any conclusions that might be drawn from changes in delta smelt abundance. An experimental approach needs greater attention to the analyses of existing information, hypothesis development, experimental design (including controls), sample sizes and duration (number of years) of the experiment. The latter two should be derived from a power analysis. In our opinion, the proposed actions for 2007 describe new management actions not scientific experiments. Consequently our answers to the five questions must be interpreted with that constraint in mind. We repeat each question followed by our answer:

1. Evaluate the technical assumptions and conceptual models underlying proposed matrix actions including action triggers, signal-to-noise ratios for response variables, measurement of response variables, and additional proposed field sampling.

We divided our answer to this question into comments on the conceptual model and comments on the stated hypotheses.

Comments on the conceptual model

A conceptual model is not specifically stated so we cannot give a definitive answer to this question. The overall working hypothesis in the Draft Supplemental Information implies a conceptual model based on the delta smelt's life cycle in which adult delta smelt migrate upstream in the winter, larvae hatch in the spring and juveniles grow while drifting downstream in the summer and autumn. Growth is determined by food availability, which is assumed to be increased by the flux of plankton from upriver and decreased by competition from the invasive clam *Corbula amurensis*. All delta smelt life stages can be entrained in the pumps. The conceptual model assumes hydrodynamics and salinity affect the spatial-temporal pattern of smelt so that alteration of Delta flows as described in the Action Matrix are assumed to affect survival and reproduction success. However, whether the net impacts of proposed actions on any life stage are significant or whether the total impact of proposed actions on the population will be biologically meaningful or detectable is largely unknown. The Action Matrix also proposed actions to increase plankton influx to the Delta. As noted in the background information (*Resource Agency Pelagic Organism Action Matrix Related to Water Operations*, November 22, 2006) the general conceptual model and hypotheses were developed after the 2006 CalFed Science Conference and reflect recent studies. However, while the inferred conceptual model apparently underlies the proposed actions for 2007, it is insufficiently detailed or developed to be used in analysis of the data or for planning experiments in the future.

The Panel recommends developing a conceptual model of the delta smelt's life history that integrates potential effects of changes in hydrologic flow conditions, water quality, fish behavior and physiology on spatial-temporal scales relevant to the life stages

of delta smelt and other pelagic organisms. The Panel suggests that the conceptual model consider delta smelt and other pelagic organisms in a broader context than simply responses to operations proposed in the Action Matrix. Considering the pelagic organisms' life history strategies and how Delta development and water operations affect those strategies would provide an ecologically based approach to the eventual design of experiments. The current conceptual model only qualitatively addresses the mismatch between the evolved behavioral and physiological patterns and the existing hydraulic and water quality conditions in the Delta. The Panel encourages the continued research and development of an explicit, spatial-temporal life-cycle model as a foundation for designing Delta-wide experiments. A serious information gap that presents a barrier to the formulation of practical hypotheses is that the in-delta spawning migration behavior of delta smelt (timing, selection of spawning sites, etc.) is not well described. Also, there is no field measure of egg production per spawner and no consideration for the effect of food availability on reproductive output in space and time. The latter, in particular, could be important in the case of repeat spawners. We suggest that a model, which reasonably characterizes the spatial temporal life history patterns, will be needed to identify action triggers, and sampling protocols for future experiments. In brief, Delta experiments can most effectively be designed and implemented, if first developed in silico.

Comments on the hypotheses

A focus on the testing of specific hypotheses is a good approach, but more planning should go into the process before actions are taken because so much uncertainty is involved. The hypotheses are in essence predictions of the effects of actions, but they do not characterize the underling mechanisms. There may be ways of objectively evaluating these as being true or false at the end of a defined time period. However, the longer the time period between an action and a predicted response, the lower the likelihood of being able to connect the two as cause and effect. The panel questions whether it is possible to evaluate the responses to actions outlined in the 2007 Action Matrix

For example, consider the May-December hypothesis: "*Higher Delta outflow in summer and fall will expand suitable habitat available to delta smelt, shifting their distribution downstream and so reducing winter entrainment.*" The primary responses are the location of X_2 and the distribution of delta smelt in the FMWT survey. A number of unstated processes link the action to the response variables and many of these are not understood or cannot be controlled. For example, the effect of increasing Delta outflow is contingent on the water year conditions, which will alter the entire hydraulic environment and distribution of smelt prior to, during and after the May-December action. The assumption underlying this prediction is that flow affects smelt distributions. The panel suggests a more relevant question would be to study or explore how flow and water quality properties affect smelt behavior that in turn determines smelt migration. The current Action Matrix and the associated monitoring are not sufficient to address this. However, an understanding of fish response is needed to understand how the population will respond to Delta-scale manipulations.

2. Evaluate response time for detecting effects of proposed actions identified in the matrix.

The Panel believes that a meaningful evaluation of the time required to detect the effect of a proposed action is vitally needed, but was not included in the Action Matrix. Whether the time required to detect responses can be quantified should be determined by an analysis of the existing data. Some understanding of the individual responses of fish to the action and the fish's response to the sampling gear will be required. Also needed is a power analysis to determine the magnitude of response necessary to confidently detect a change in abundance, size distributions, etc. using the proposed sampling methods.

3. Provide input on response variables and the relationship between multiple year responses to single- or multiple-year actions.

A consistent problem in ecology is separating the effects of natural variation from the response to a planned action. Identifying the effects of actions whose responses are measured in later life stages or subsequent generations is especially difficult. Most of the response variables in the Action Matrix are affected by demographic processes as well as seasonal environmental variability. Consequently, detecting interannual responses will be extremely difficult given the level of effort identified. To further complicate the issue the plan has numerous actions, so attribution of a cause is speculative. In essence, it is highly unlikely that the specific effects of single or multiple-year actions can be identified.

4. Provide independent perspective regarding characterization of scientific uncertainty in proposed actions and responses.

The panel encourages the use of uncertainty assessments in designing experimental procedures. However, the Panel has insufficient information to apportion uncertainty in the 2007 actions. Given the limitations of the existing knowledge base, the large scope for variability in the system, and the generally high level of scientific uncertainty expressed in the best professional judgment of agency personnel, it would be unrealistic to expect results that had much predictive value.

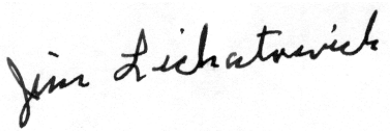
5. Evaluate potential contribution of proposed actions and subsequent measurements to improving estuary-wide knowledge base regarding declining pelagic species.

It appears the responses to the proposed actions will be observed with the existing Delta monitoring programs. Because it is still unresolved as to how past variation in the Delta water quality and hydraulics has affected the delta smelt distribution and population, it seems unlikely that modest changes on top of the natural conditions in 2007 will be informative.

We interpreted question six in our charge as a direct reference to the Action Matrix, so this letter will serve as our review of the Action Matrix as well as the answer to question six in our overall charge.

We appreciate the opportunity to comment on the Action Matrix.

Sincerely,



Jim Lichatowich
For the entire panel

Panel Members: Jim Anderson, Jim Cowan, Ron Kneib, Jim Lichatowich, Steve Monismith, Kenny Rose, Paul Smith, Andy Solow, and Buzz Thompson.